

## Claims

We Claim:

- 1) A composition of matter comprising an aerogel having a high density of hydroxyl groups.
- 5 2) The composition of matter of claim 1, wherein said aerogel is a ceramic oxide.
- 3) The composition of matter of claim 2, wherein said ceramic oxide is selected from the group consisting of silica, alumina, aluminosilicate, and combinations thereof.
- 10 4) The composition of matter of claim 1, wherein said hydroxyl groups are greater than preferably greater than 1 hydroxyl groups per square nanometer of the surface of the aerogel.
- 5) The composition of matter of claim 1, wherein said hydroxyl groups are greater than preferably greater than 3 hydroxyl groups per square nanometer of the surface of the aerogel.
- 15 6) The composition of matter of claim 1, wherein said hydroxyl groups are greater than preferably greater than 5 hydroxyl groups per square nanometer of the surface of the aerogel.
- 20 7) The composition of matter of claim 1 wherein said aerogel having said high density of hydroxyl groups has pore sizes of between 150 Å and 250 Å and bottlenecks of between 110 Å and 150 Å.
- 8) A method for forming an aerogel having a high density of hydroxyl groups comprising the step of exposing an aerogel to a mixture of water and a supercritical fluid.
- 9) The method of claim 8, wherein said aerogel is provided as a ceramic oxide.

- 10) The method of claim 8, wherein said ceramic oxide is provided as selected from the group consisting of silica, alumina, aluminosilicate, and combinations thereof.
- 11) A composition of matter comprising an aerogel having pore sizes of between 150 Å and 250 Å and bottlenecks of between 90 Å and 150 Å.
- 12) The composition of matter of claim 11, wherein said aerogel is a ceramic oxide.
- 13) The composition of matter of claim 12, wherein said ceramic oxide is selected from the group consisting of silica, alumina, aluminosilicate, and combinations thereof.
- 14) A composition of matter comprising an aerogel having a pore size distribution of less than 50% of the mean pore diameter.
- 15) The composition of matter of claim 14, wherein said pore size distribution is less than 20% of the mean pore diameter.
- 16) The composition of matter of claim 14, wherein said pore size distribution is less than 10% of the mean pore diameter.